A Demonstration of Submerged Aquatic Vegetation/Limerock Treatment System Technology for Removing Phosphorus From Everglades Agricultural Area Waters
Sixth Monthly Report

Prepared for:
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
and
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road, MS 3560
Tallahassee, FL 32399-2400

Prepared by:
DB Environmental Laboratories, Inc.
414 Richard Rd.
Rockledge, FL 32955

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Introduction

On February 12, 1998, the District contracted with DB Environmental Laboratories, Inc. (DBEL) to design, construct, operate, and evaluate a 13-month, tank-scale (i.e., "mesocosm") demonstration of SAV/ Limerock Treatment System technology for reducing P discharge from EAA waters. The objectives of this project are twofold. First, obtain the performance data and operational experience necessary to evaluate the technical, economic, and environmental feasibility of using SAV/Limerock technology for P removal at either the watershed basin- or farm-scale. Second, guide the design and operation of a larger, field-scale SAV/Limerock demonstration project should the District choose to investigate this technology further. This report summarizes progress during the tenth month (project weeks 45 - 49) by DB Environmental Laboratories, Inc. (DBEL) on the Submerged Aquatic Vegetation/Limerock (SAV/LR) demonstration project.

Synopsis of Progress to Date

North Project Site

All experiments at the North Supplemental Technology Site are proceeding according to the attached schedule (Fig. 1). As noted in November 1998, P concentrations in the agricultural drainage water in December and January were highly variable at this location, presumably due to fluctuations in rainfall in the Everglades Agricultural Area and variable pumping rates of the ENR influent and S-5 pump stations. From the period mid-December through mid-January, influent total P concentrations (based on weekly composite samples) ranged from 35 to 142 ppb, and averaged 86 ppb. These lower influent total P concentrations have led to "record" low effluent concentrations from the SAV/LR systems. In the HRT study (subtask 4C), average P levels over the past four weeks through the process train (influent, SAV effluent, 5 hr LR bed effluent) were: 86, 30 and 32ppb for the 1.5 day HRT SAV/LR system; 86, 15 and 11ppb for the 3.5 day HRT system; and, 86, 10 and 7ppb for the 7.0 day HRT system.

During December 1998 we collected our second set of "extended" water quality parameters (i.e., nitrogen species, minerals, color, etc.) from the HRT study tanks. These data are depicted in figures 2 - 5. As was observed on our first sampling of these parameters, concentrations of most constituents declined with passage through the SAV/LR process trains. Two exceptions were TSS and dissolved Fe, for which concentrations increased for some of the SAV mesocosm effluents.

South Project Site

All mesocosms at the South Site continue to perform well, although the total P concentration of the influent (=ENR effluent) fed to these systems has been extraordinarily low, ranging from 9 to 15 ppb. From mid-December to mid-January, the shallow (10 cm), low velocity SAV/LR system has reduced average influent total P levels (12 ppb) to a mean of 6 ppb. The deeper (60 cm deep) low velocity system has reduced average influent total P levels of 11ppb to 7ppb.

During December 1998 we collected samples from the shallow and deep low velocity systems for analysis of a suite of water quality constituents (Figs. 6 - 9). As was noted in some of the north site tanks, there was a slight increase in dissolved Fe with passage through the SAV system. This sampling also showed one anomalous result, in that ammonium and TKN concentrations in the deep mesocosm influents were higher than these constituent levels in the shallow mesocosm influent. The two influent samples were collected several minutes apart, and may indeed represent true temporal differences in N characteristics of water parcels fed through the influent plumbing of our system.

In our third SAV configuration, the shallow (1 cm deep), high velocity raceway, we continue to observe a periphyton productivity gradient in these systems, with highest biomass production occurring in the influent region. We also have found a decline in tissue N and P content with distance down the raceways. Productivity and elemental composition data for the periphyton in the high velocity system for the period mid-August to December 1988 are depicted in figures 10 - 15.

Sediment, Vegetation and Water Quality Measurements in the ENR

Subtask 5A of this demonstration project entails field observations of different SAV communities in the ENR project. On December 19 and 20, 1998, we performed water quality, vegetation and sediment sampling in two of the ENR Cells. Cell 4 is dominated exclusively by SAV, primarily *Najas*, with some *Ceratophyllum*, *Potamogeton*, and *Chara*. Cell 1 contains dense cattail stands along the eastern edge, as well as in the influent and effluent regions of the cell. The middle of the Cell 1 is now open water populated with SAV beds containing the above species as well as *Hydrilla*.

Analyses of plants and sediments collected from ENR Cell 4 are still underway. Our water sampling from Cell 1, however, has confirmed many of the observations from our north site SAV mesocosms. For example, the experimental SAV mesocosms rapidly strip SRP from the influent drainage water. In the water column of SAV beds in ENR Cell 1, we also found SRP concentrations to be quite low, averaging 6 ppb during the day and 8ppb at night (daytime data represent means of 9 surface and 9 bottom stations; nighttime data represent 3 surface and 3 bottom stations). This is in marked contrast to the water column in cattail beds, where we found average SRP levels of 50ppb during the day and 55ppb at night.

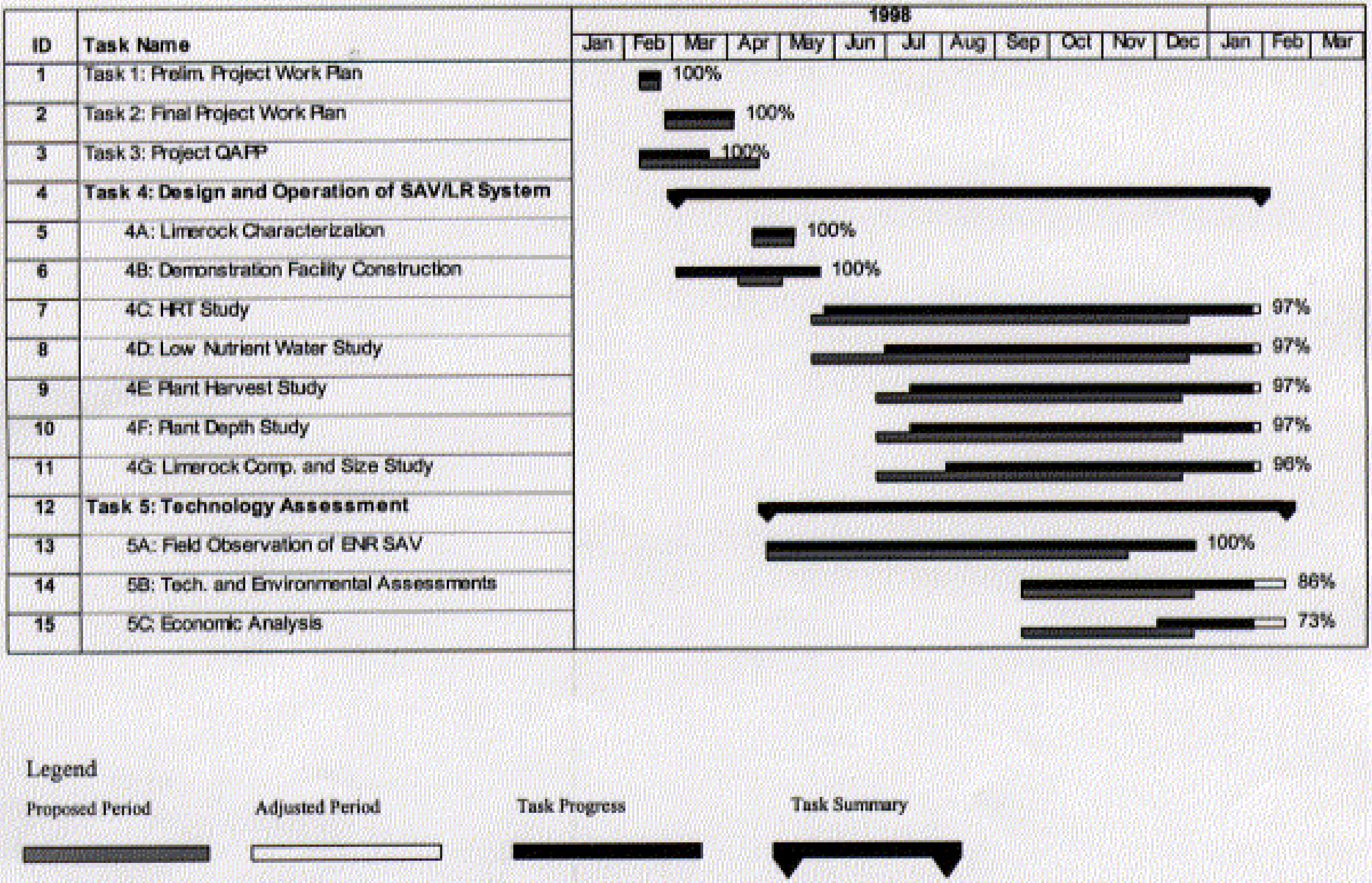
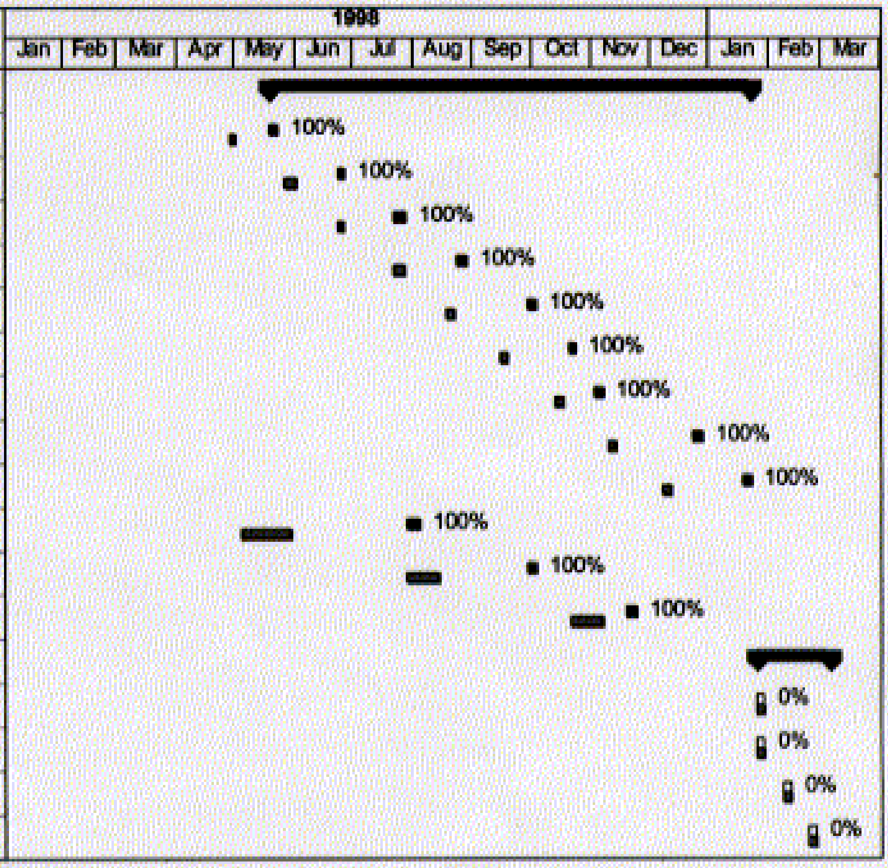


Figure 1. SAV/Limerock Project Schedule

ID	Task Name
16	**Task 6: Status Reports and Review Meetings**
17	1st Quarterly Report
18	1st monthly Report
19	2nd Monthly Report
20	2nd Quarterly Report
21	3rd Monthly Report
22	4th Monthly Report
23	3rd Quarterly Report
24	5th Monthly Report
25	6th Monthly Report
26	1st Quarterly Meeting
27	2nd Quarterly Meeting
28	3rd Quarterly Meeting
29	**Task 7: Final Work Products**
30	Raw data, Hard copy and Electronic
31	Draft Final Report
32	Final Project Meering
33	Final Report



Legend

Figure 1 (cont.) SAV/Limerock Project Schedule

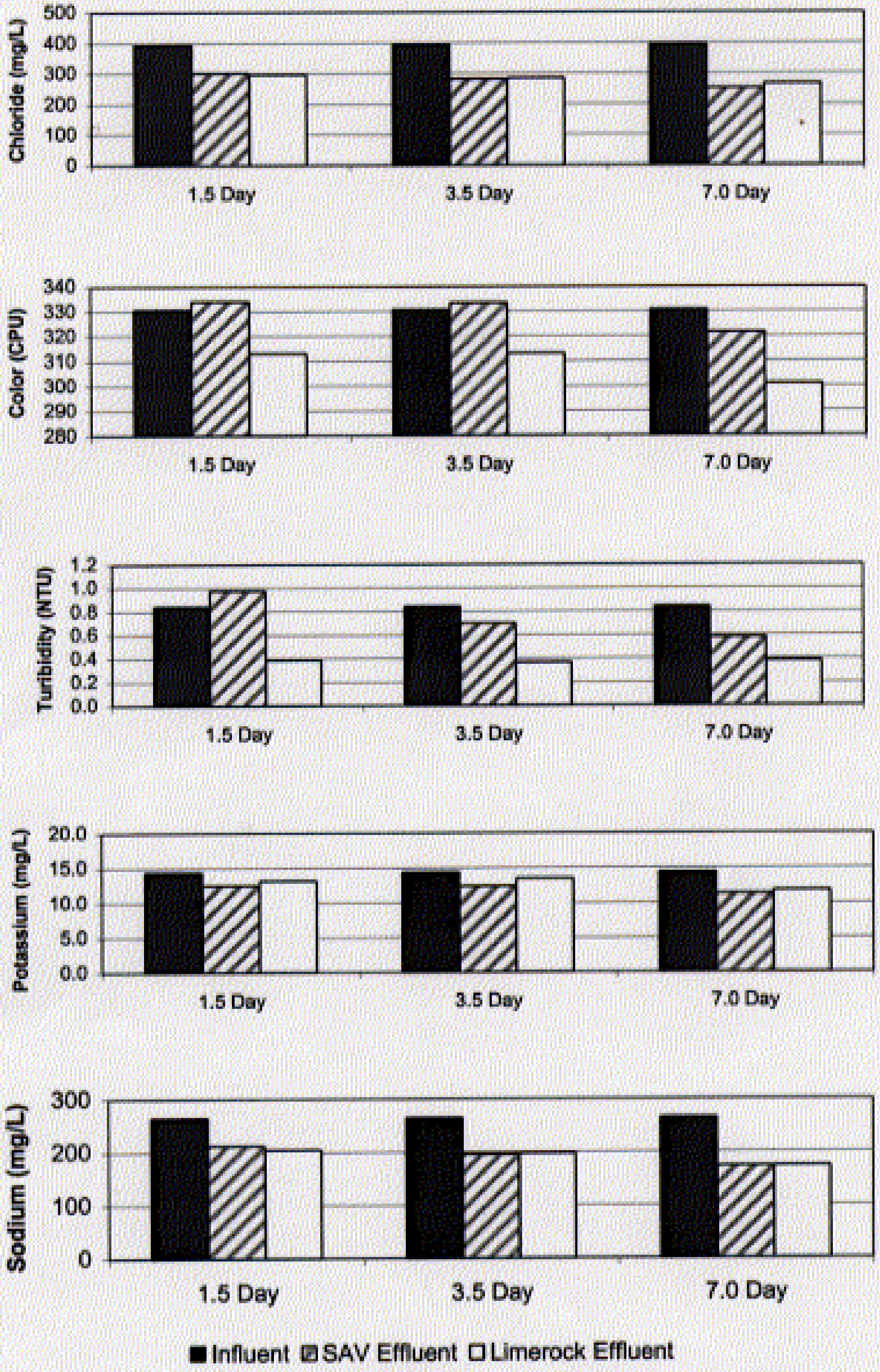


Figure 2. Mean water quality characteristics (n=2) at three locations in the SAV/LR process train. Data for three SAV HRT's are depicted.

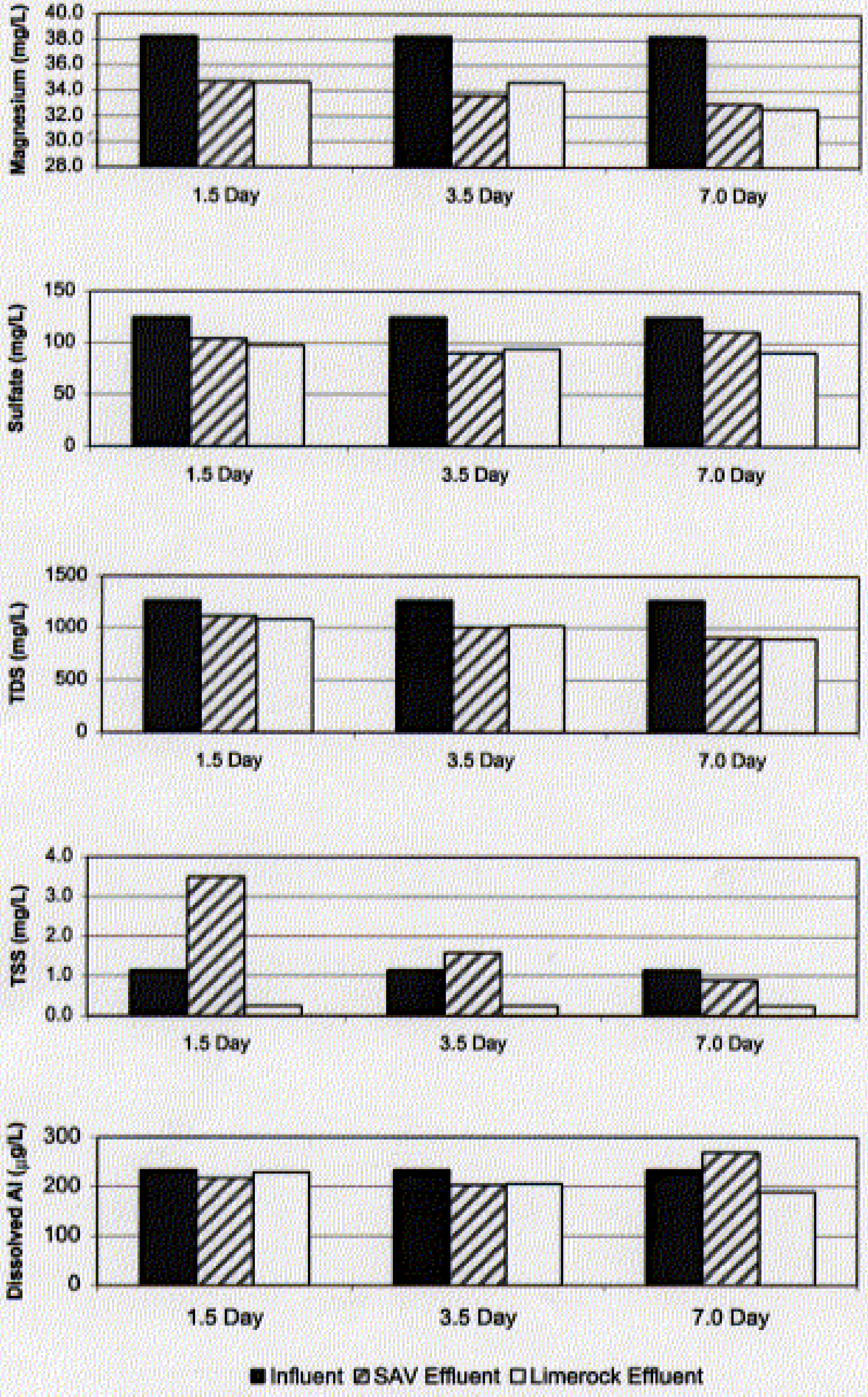


Figure 3. Mean water quality characteristics (n=2) at three locations in the SAV/LR process train. Data for three SAV HRT's are depicted.

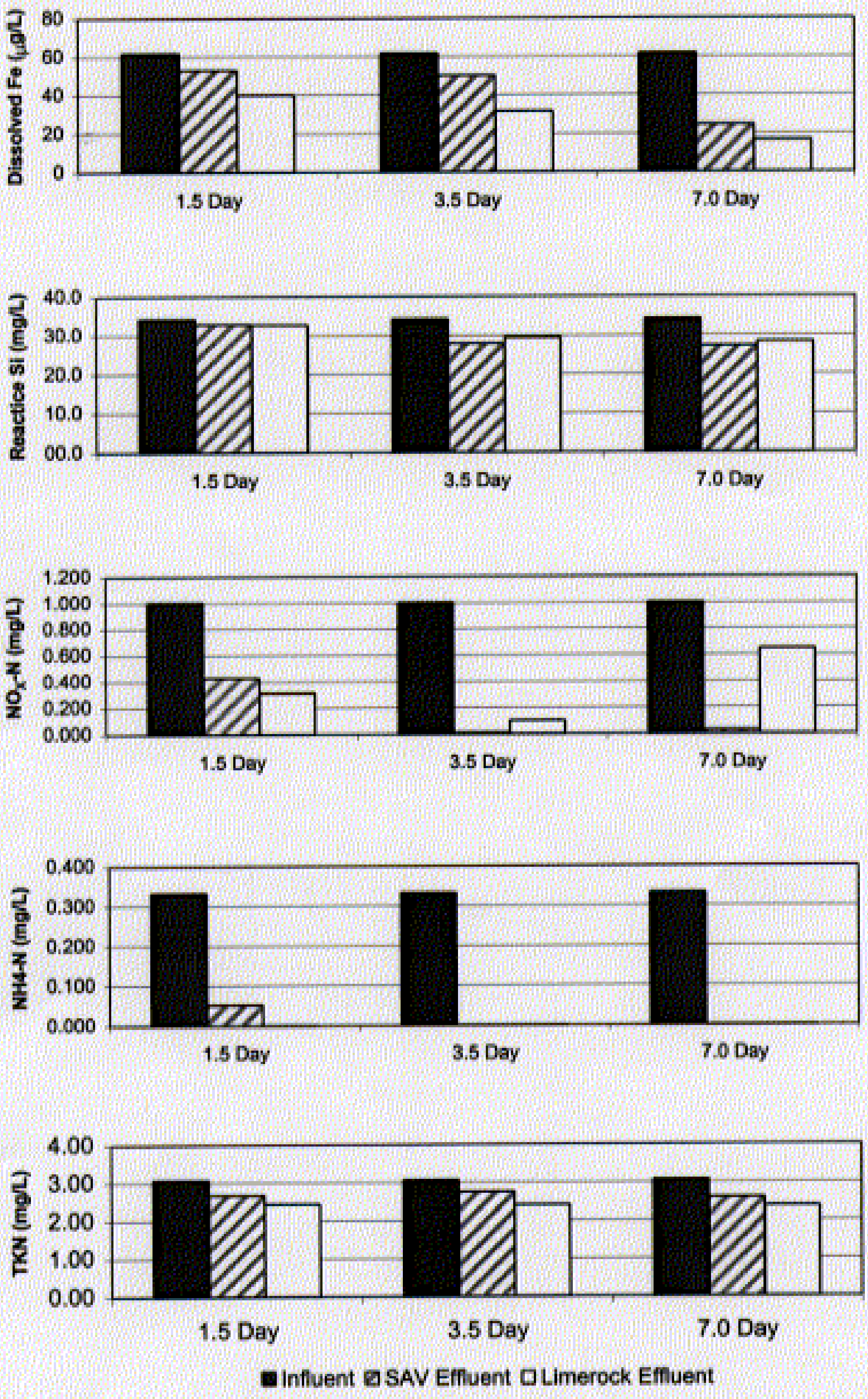


Figure 4. Mean water quality characteristics (n=2) at three locations in the SAV/LR process train. Data for three SAV HRT's are depicted.

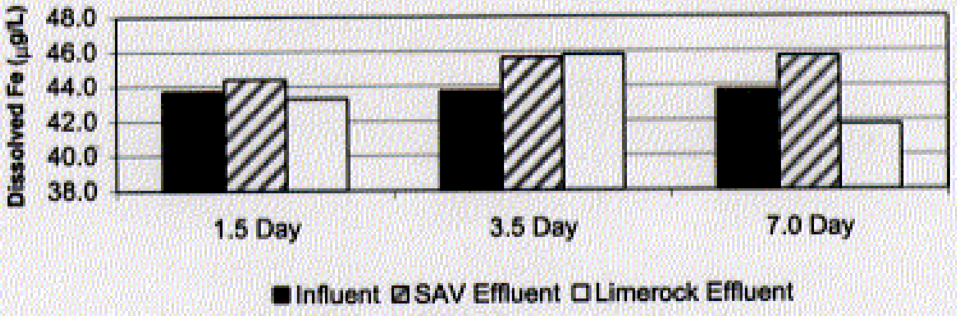


Figure 5. Mean water quality characteristics (n=2) at three locations in the SAV/LR process train. Data for three SAV HRT's are depicted.

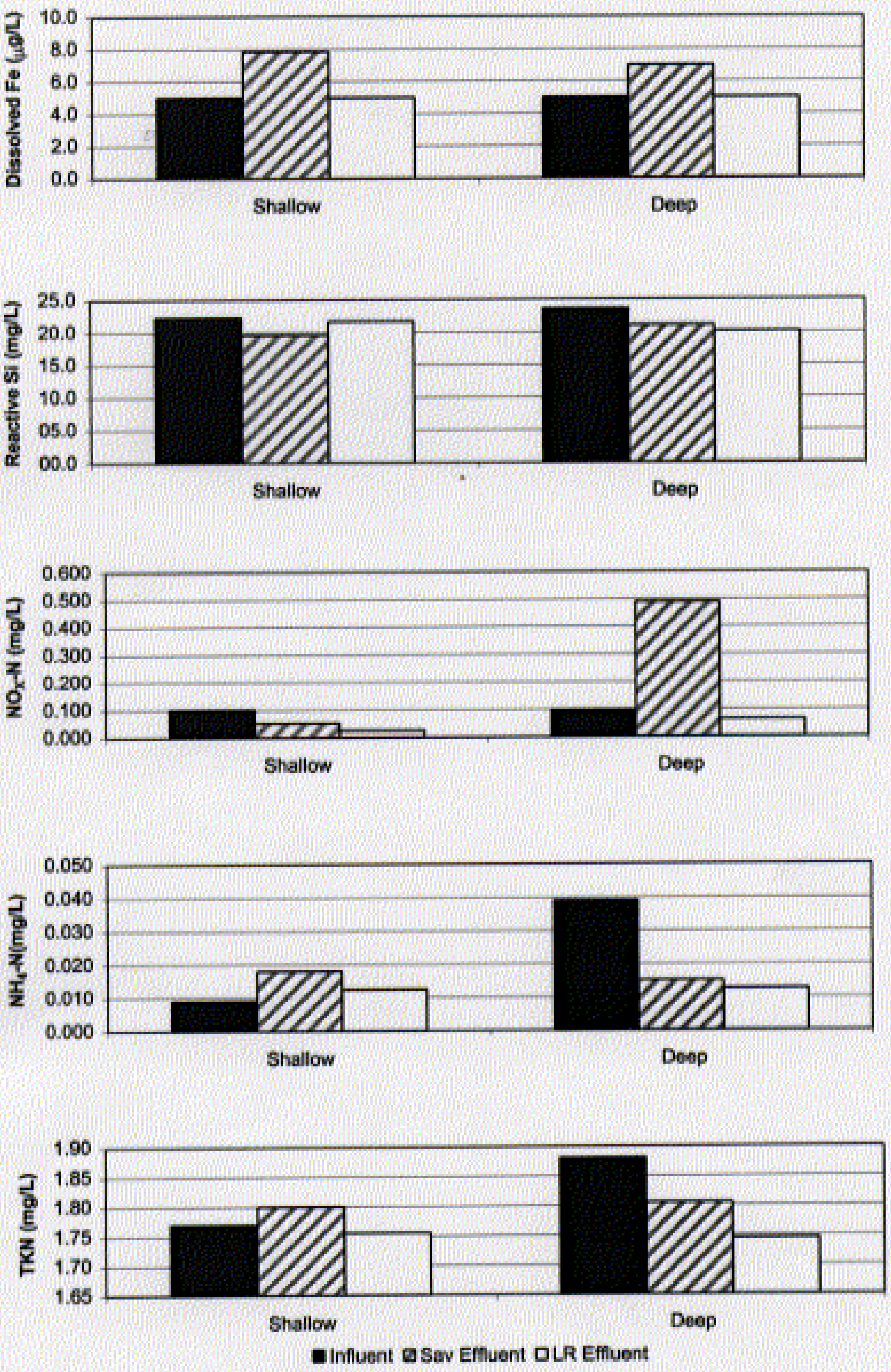


Figure 6. Mean water quality characteristics (n=2) at three locations in each of the shallow and deep, low velocity SAV/LR process trains.

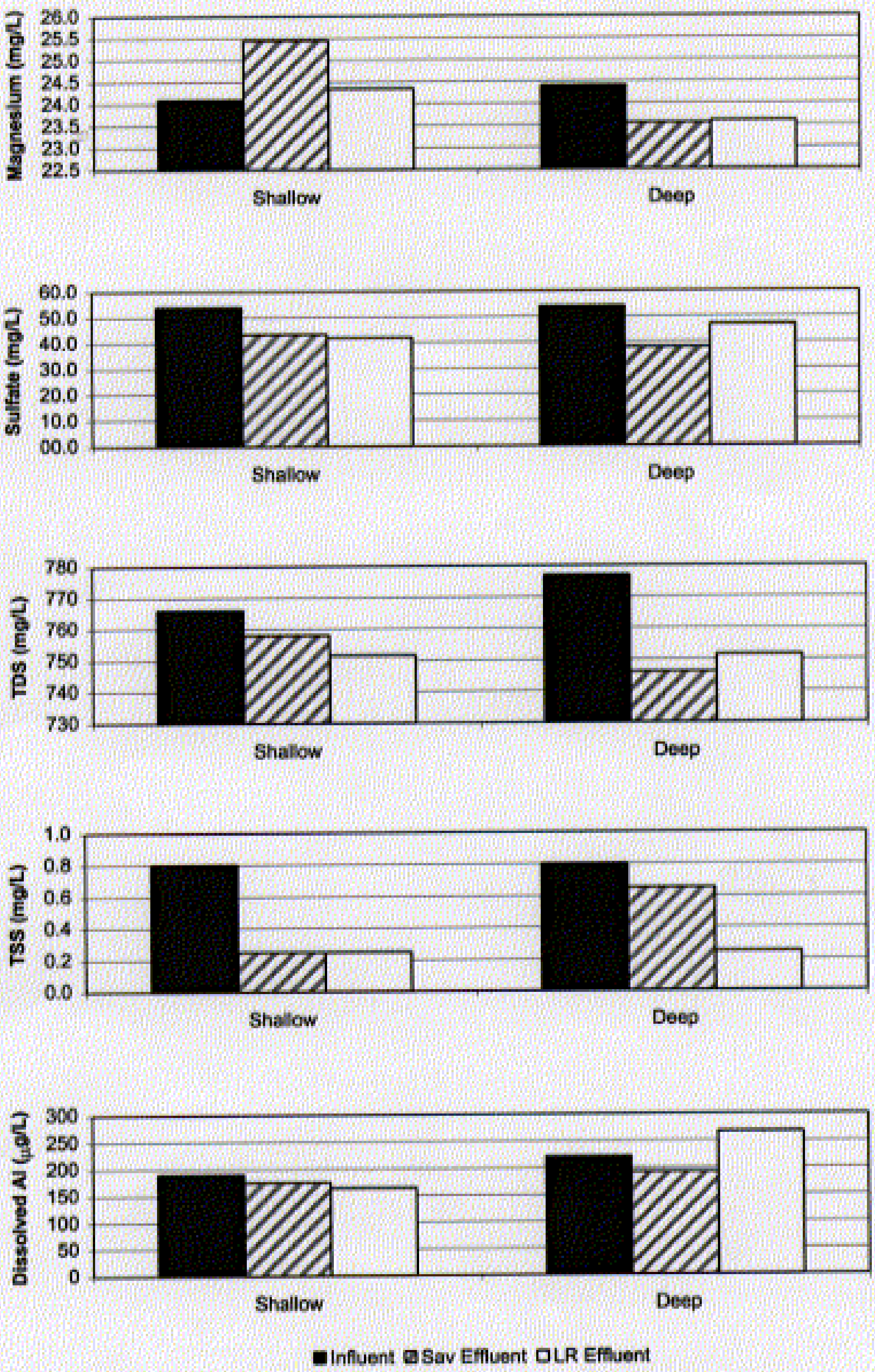


Figure 7. Mean water quality characteristics (n=2) at three locations in each of the shallow and deep, low velocity SAV/LR process trains.

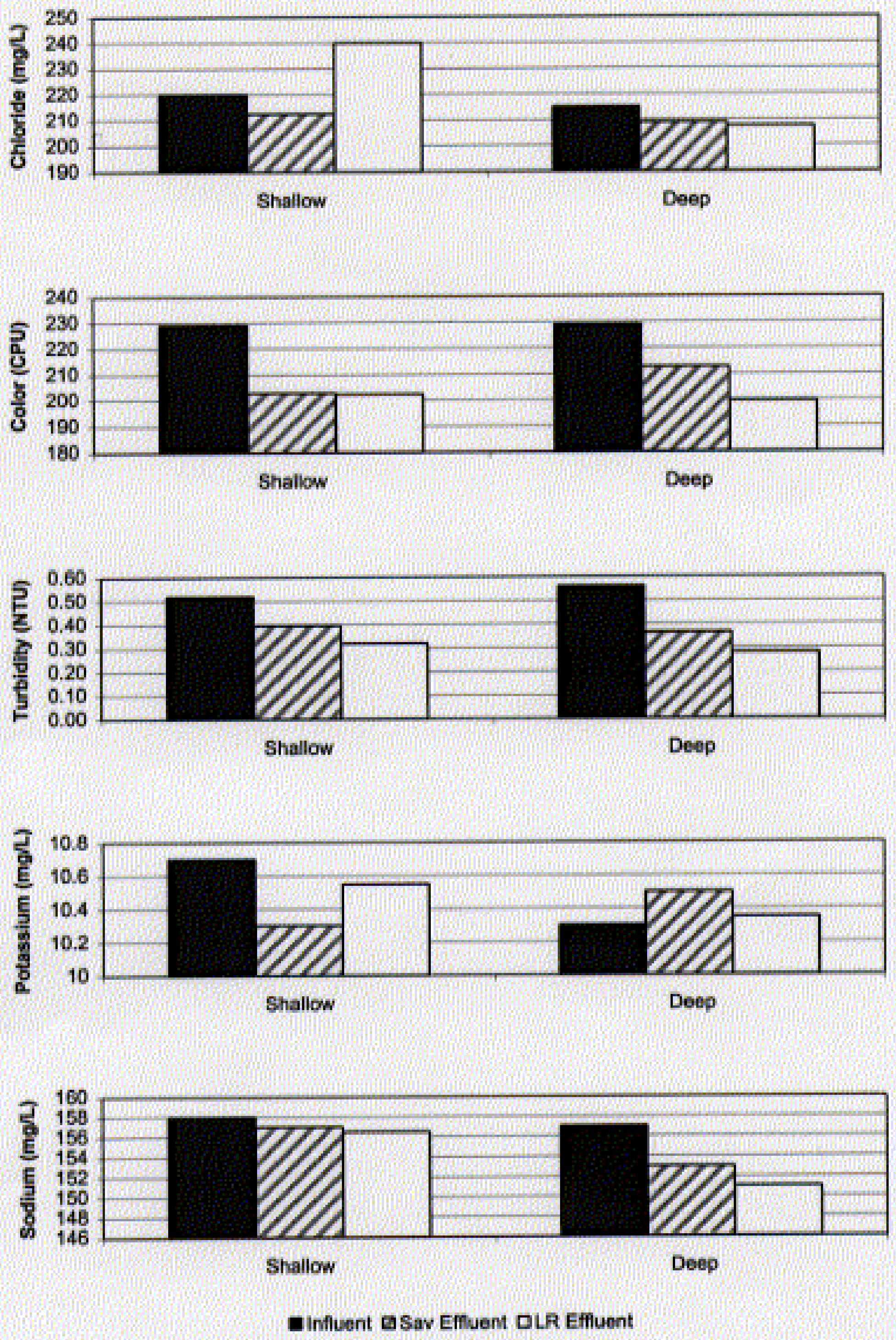


Figure 8. Mean water quality characteristics (n=2) at three locations in each of the shallow and deep, low velocity SAV/LR process trains.

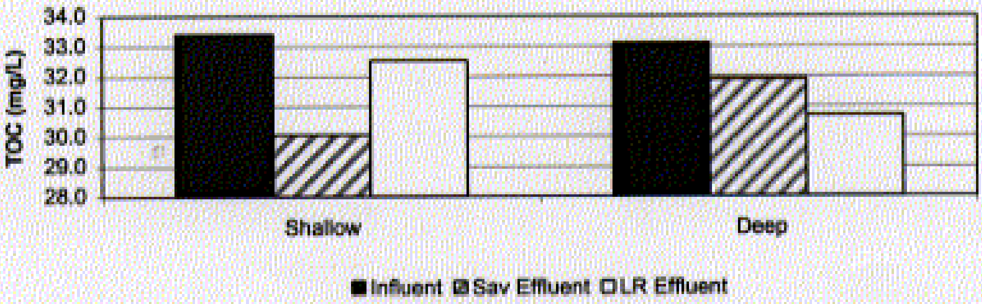


Figure 9. Mean water quality characteristics (n=2) at three locations in each of the shallow and deep, low velocity SAV/LR process trains.

Productivity

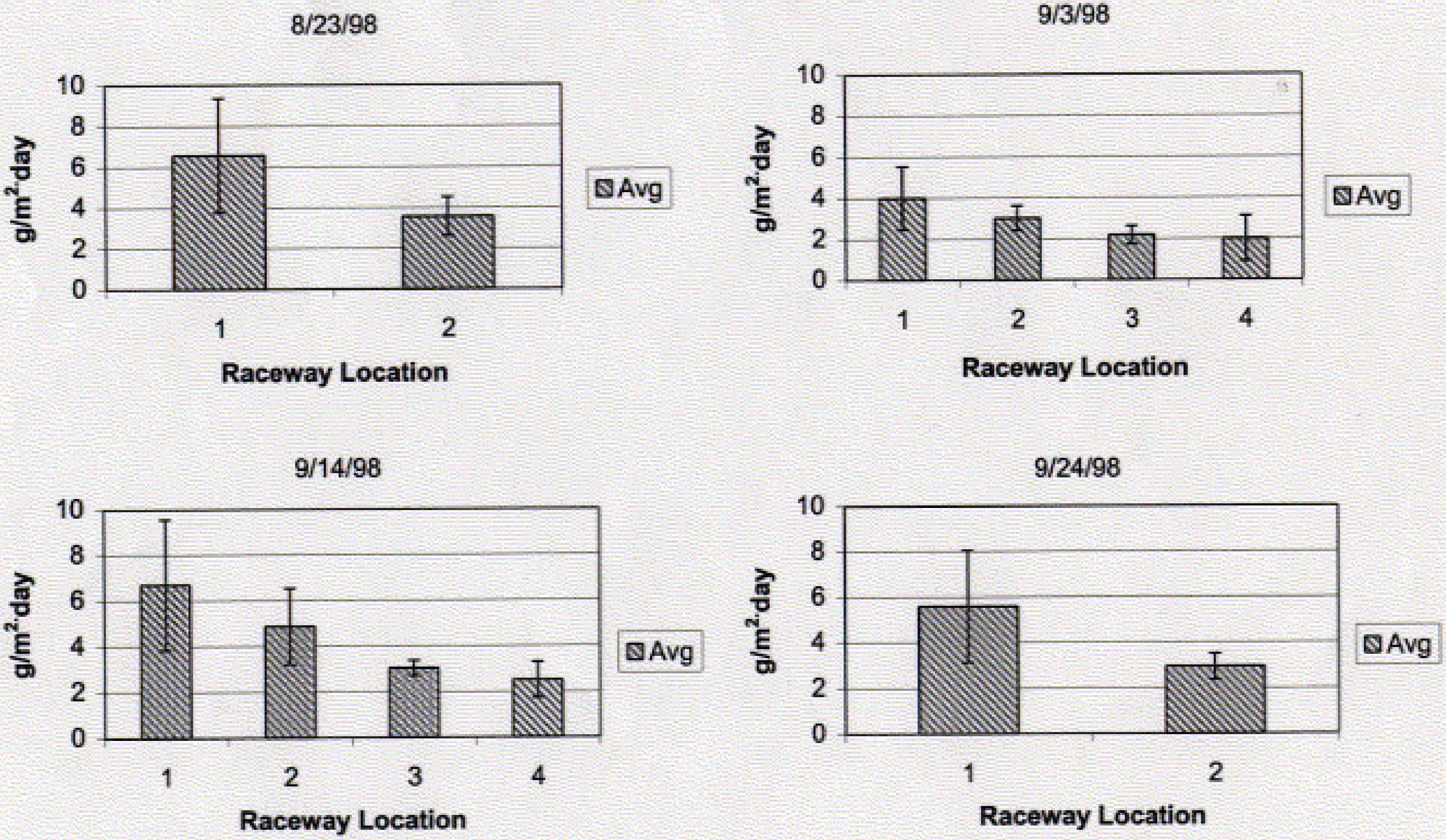


Figure 10. Productivity of periphyton (n=3) in the shallow, high velocity raceways. Locations reflect influent region (1), mid-regions (2 & 3) and effluent region (4) of the raceway.

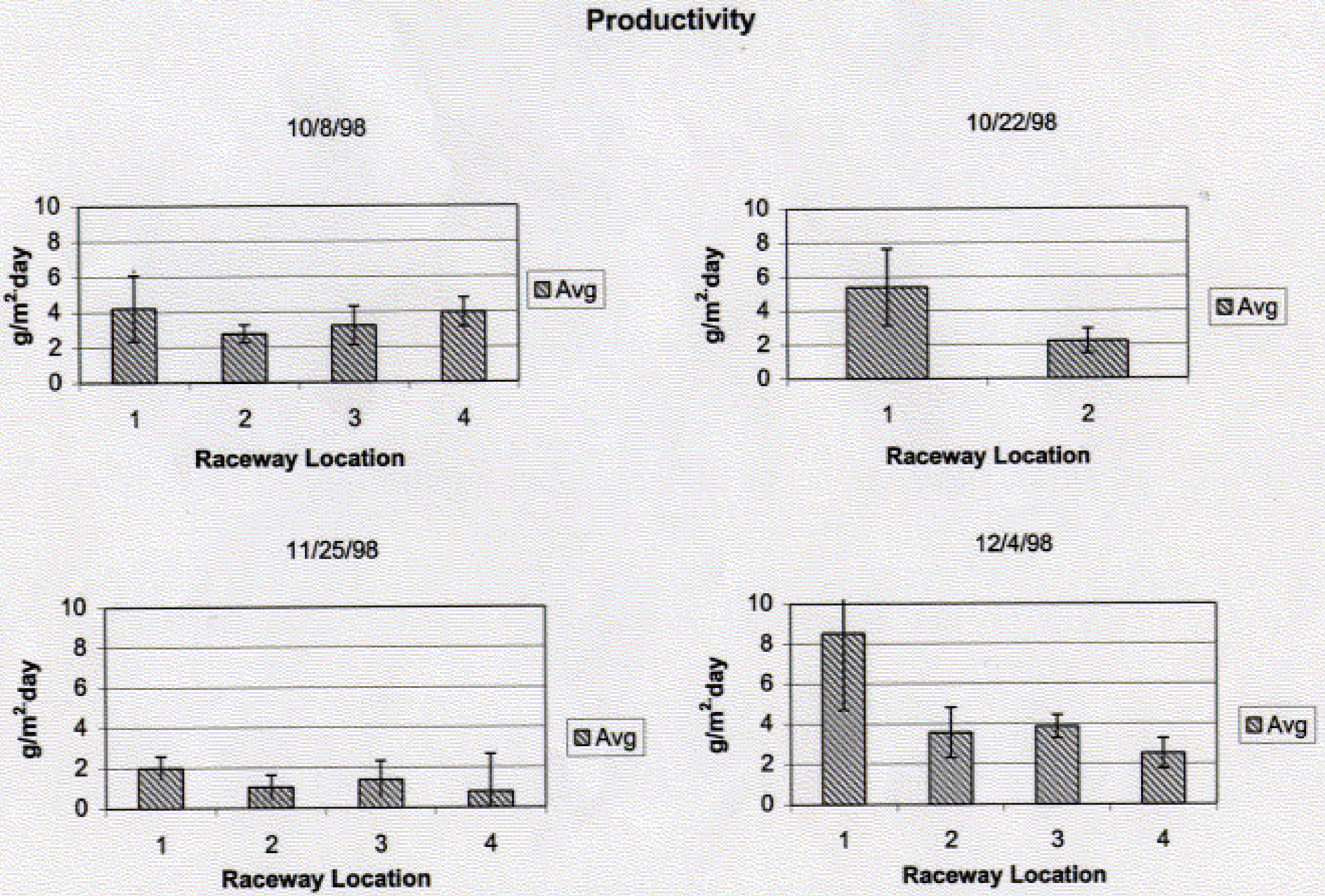


Figure 11. Productivity of periphyton (n=3) in the shallow, high velocity raceways. Locations reflect influent region (1), mid-regions (2 & 3) and effluent region (4) of the raceway.

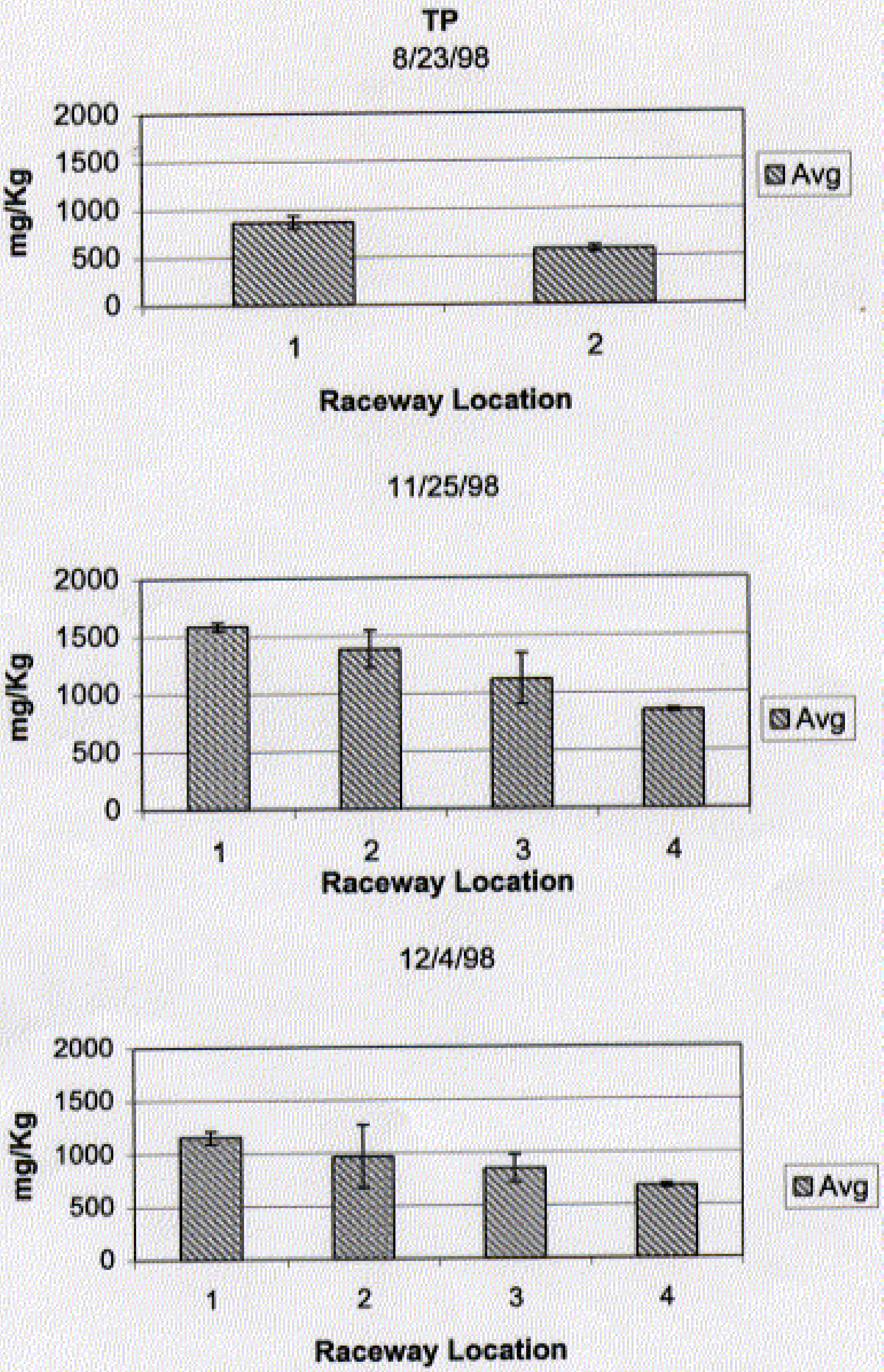


Figure 12. Total P concentrations of periphyton (n=3) in the shallow, high velocity raceways. Locations reflect influent region (1), mid-regions (2 & 3) and effluent region (4) of the raceway.

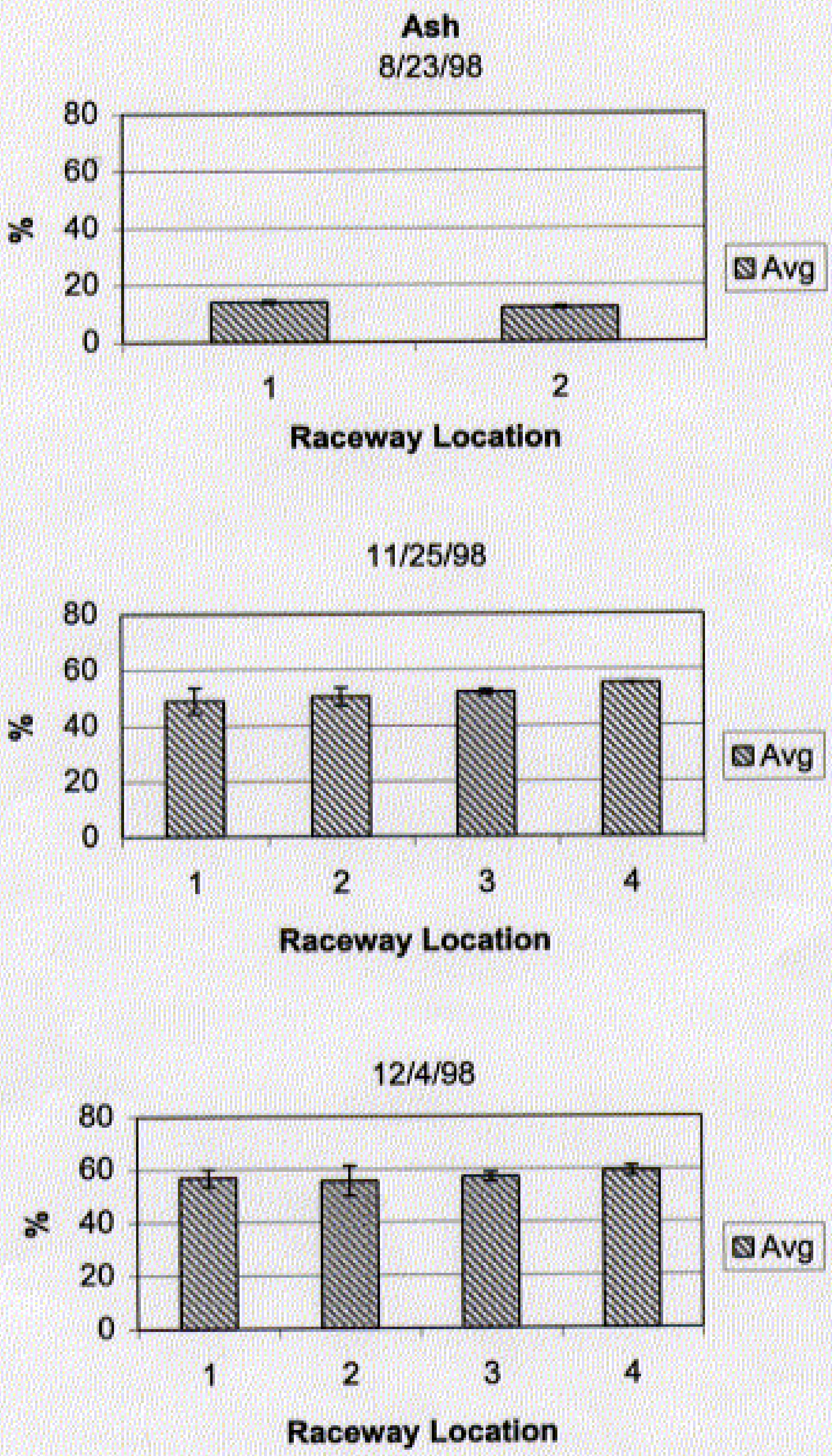


Figure 13. Ash content of periphyton (n=3) in the shallow, high velocity raceways. Locations reflect influent region (1), mid-regions (2 & 3) and effluent region (4) of the raceway.

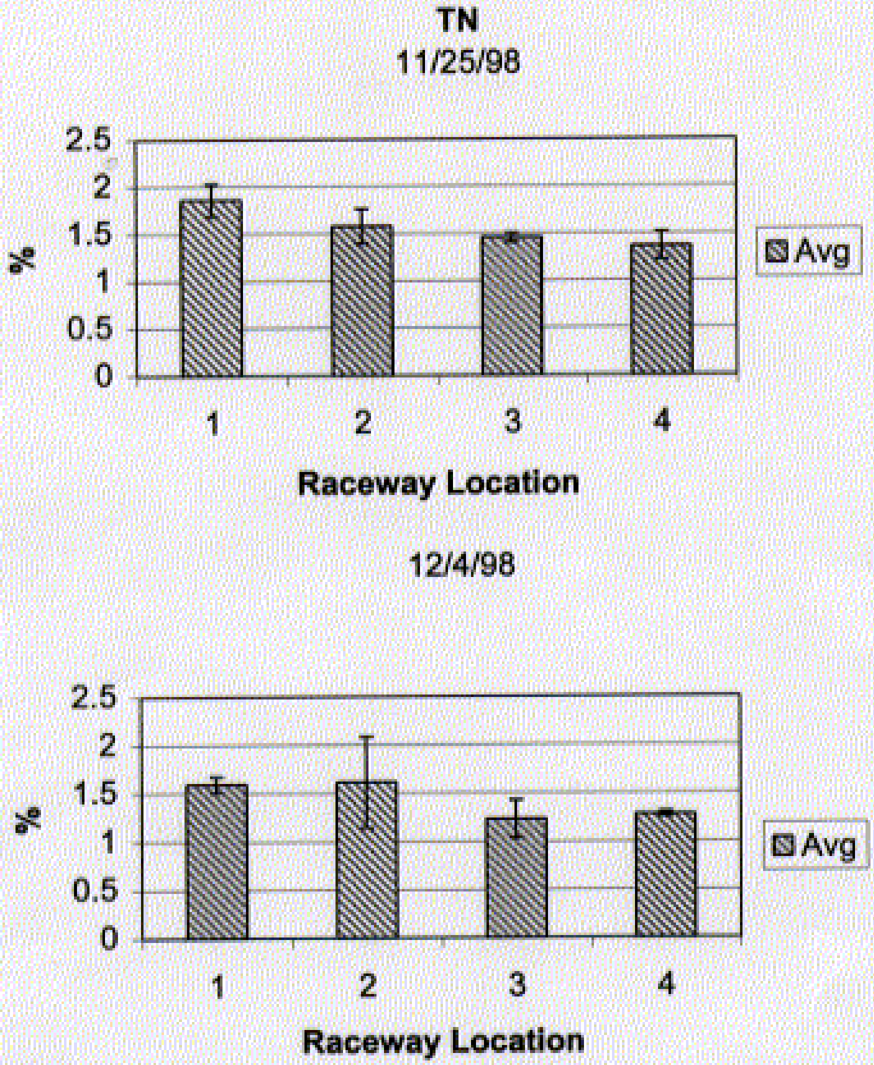


Figure 14. Nitrogen content of periphyton (n=3) in the shallow, high velocity raceways. Locations reflect influent region (1), mid-regions (2 & 3) and effluent region (4) of the raceway.

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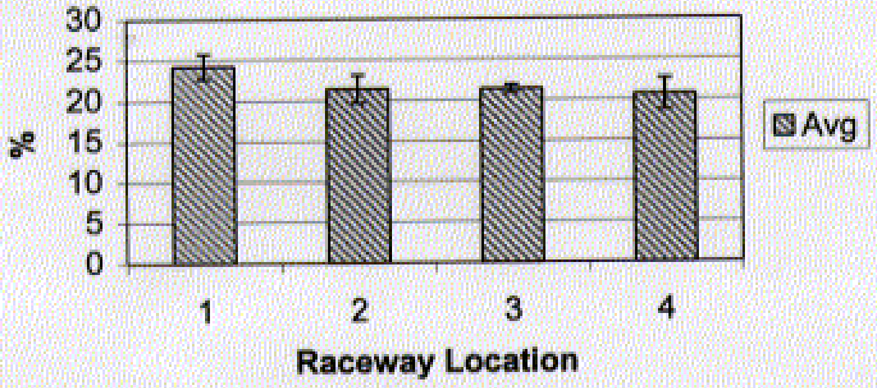

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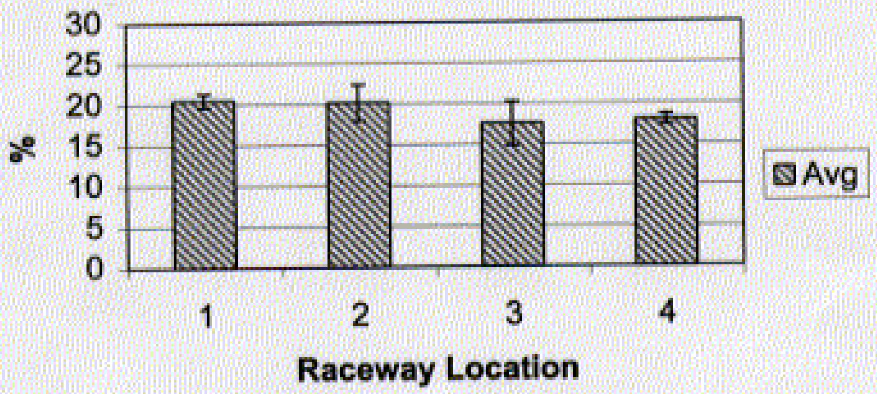

Figure 15. Carbon content of periphyton (n=3) in the shallow, high velocity raceways. Locations reflect influent region (1), mid-regions (2 & 3) and effluent region (4) of the raceway.